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Ultrasonic absorption in binary mixtures of CS_2

K. Samal and S. C. Misra

Post Graduate Physics Department, Utkal University, Vani-Vihar, Bhubaneswar-4, India,

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It has been reported by Samal & Das (1967) that the coefficient of of ultrasonic absorption of CS_2 decreases more when mixed with xylene ($\alpha/f^2=78\times10^{-17}$c.g.s.) than with kerosine ($\alpha/f^2=110\times10^{-17}$ c.g.s.). This gives an impression that the lower the absorption coefficient of an impurity the more effective it is in reducing the absorption coefficient of CS_2. A calculatlon from Bauer's theory (1949) gives also similar indication when tried with benzene-toluene and benzene-carbon tetrachloride mixtures. But the theory does not fit well to the experimental findings of Samal & Das (1967) in case of binary mixtures of xylene and kerosene with CS_2 as one of the components in each.

Table 1.

C_6H_6 (0.878 gm/cc) in CS_2 mole fraction $\times 10^3$	$\alpha/f^2\times10^{17}$ c.g.s.	CCl_4 (1.596 gm/cc) in CS_2 mole fraction $\times 10^3$	$\alpha/f^2\times10^{17}$ c.g.s.	CH_3I (2.285gm/cc) in CS_2 mole fraction $\times 10_3$	$\alpha/f^2\times10^{17}$ c g.s.
0.63	5533	0.63	5379	0.972	4906
1.36	5187	1.251	5272	2.908	4599
2.04	4256	1.876	5169	4.827	4260
4.73	3773	3.124	4793	8.674	3881
8.43	3457	4.367	4383	12.000	3493
11.80	3320	5.608	4150	16.730	3119
16.70	3074	10.870	3473	23.730	2882
20.00	2863	15.420	3391	28.340	2569
26.50	2636	18.450	3259	37.430	2460
32.80	2558	25.060	2870	46.360	2184
39.20	2442	31.320	2643	55.120	2079
45.40	2305	36.230	2468	63.720	1902
51.60	2243	42.020	2219	—	—
57.60	2102	47.730	2050	—	—
63.40	2948	53.390	1916	—	—
—	—	58.950	1601	—	—

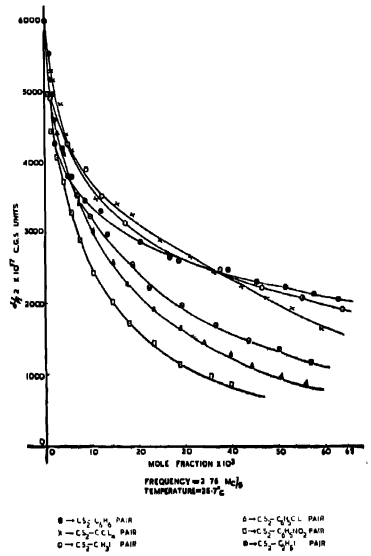
In order to test the theory further, a number of unassociated liquids like C_6H_6, CCl_4. CH_3I, C_6H_5Cl, $C_6H_5NO_2$ and C_2H_5I with their α/f^2 values (α-amplitude abs. coeff. and f-frequency) ranging from 900×10^{-17} c.g.s. to 40×10^{-17} c.g.s, are added separately as impurities to CS_2 and the variation of α/f^2 of the mixture with the concentration of the impurity in each case is shown graphically on a common scale for contast.

TABLE 2

C_6H_5Cl (1.107gm/cc in) CS_2 mole fraction $\times 10^2$	$\frac{\alpha}{f^2}\times10^{17}$ c.g.s.	$C_6H_5NO_2$ (1.197 gm/cc) in CS_2 mole fraction $\times 10^2$	$\frac{\alpha}{f^2}\times10^{17}$ c.g.s.	C_2H_5I (1.943 gm/cc) in CS_2 mole fraction $\times 10^2$	$\frac{\alpha}{f^2}\times10^{17}$ c.g.s.
0.591	5284	0.588	5458	0.753	5318
1.181	4931	1.116	4968	1.503	4986
1.770	4613	1.750	4475	2.253	4603
2.947	4439	2.912	4068	3.750	4199
4.121	4110	4.065	3724	5.242	3799
7.334	3414	5.254	3292	6.730	3520
10.238	3040	7.300	2906	9.324	3234
14.563	2551	10.100	2432	13.000	2992
17.394	2219	14.400	2016	18.480	2546
23.100	1881	17.320	1708	22.090	2216
28.622	1632	22.850	1454	29 230	1917
33.616	1451	28.360	1124	26.280	1685
44.159	1088	35.040	982	43.220	1468
50.430	957	39.280	823	50.060	1337
55.810	872	—	—	56.800	1185

The coefficients of ultrasonic absortion of the mixtures of the liquids supplied by E. Merck were determined at a fairly constant temperature of 25.7°C with the optical arrangement reported by Samal (1956). The ultrasonic transducer being a rectangnlar quartz of natural frequency 1 mc/s, was made to vibrate at 2.76 mc/s inside the mixtures of CS_2. The density of CS_2 is taken to be 1.26 gm/cc and the values for other liquids are given in the tables, by the sides of the liquids.

One can easily note from the graphs of CS_2–C_6H_6 and CS_2–CCl_4 that benzene with higher absorption coefficient has reduced the absorptions coefficient of CS_2 more effectively that CCl_4 of relatively lower



absorption coefficient. But in the case of liquids of similar structures (C_6H_6, C_6H_5Cl, and $C_6H_5NO_2$) the fall in the absorption coefficient is more rapid the lower the value of α/f^2 of the impurity. This needs more critical analysis of the experimental finding as well as the theory.

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